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Science and Innovation Investment Framework 2004-2014: Annual Report 2007

July 2007

HM TREASURY

Department for
Innovation, Universities and Skills

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Executive Summary

This third Annual Report on the Science and Innovation Investment Framework 2004-2014 finds that good progress has been made over the past year in implementing the programme. Key highlights include:

- the UK remains second only to the US in global scientific excellence, despite increasing international competition;
- the backlog in capital investment for research infrastructure has been reduced to a manageable level;
- knowledge transfer and commercialisation activities from the science base continue the positive trend of recent years, with increases in licensing and consultancy income and growth in the number of spin-outs created over the past year;
- there has been an encouraging increase in the proportion of young people reaching expected levels in mathematics and science, and applications for science, technology, engineering and mathematics (STEM) subjects at undergraduate level have also increased;
- business investment in R&D is growing in real terms and is keeping pace with GDP growth, though more rapid growth is needed to meet the long-term ambitions set out in the ten-year framework. The Technology Strategy Board (TSB), which became an arms-length body on 1 July 2007, will have an enhanced leadership role in driving up future levels of UK innovation performance.

Looking ahead, the forthcoming Sainsbury Review will recommend further action to ensure that the UK science and innovation system is fit to meet the challenges and opportunities of globalisation and drives future economic growth, building on the progress that has been achieved so far. The new Department for Innovation, Universities and Skills (DIUS) will lead on taking this agenda forward.

INTRODUCTION

1.1 The third annual report on the *Science and Innovation Investment Framework 2004-2014* and the *Science and Innovation Investment Framework 2004-2014: Next Steps* describes progress against the policies and actions necessary to realise the Government's ambition of creating a knowledge based economy. The ten-year framework set out a long-term vision for UK science and innovation across six broad themes[1], which form the main structure of this report. Each chapter outlines evidence of progress against that theme including key developments over the past year.

1.2 In an increasingly knowledge-driven global economy, countries will derive their competitive edge from the speed with which they are able to innovate. The UK is well-placed to thrive in the global competition for knowledge and skills, with a track record of scientific excellence and leading R&D-intensive businesses in a number of key sectors. However, in order to make the most of the opportunities of globalisation, further steps are needed to underpin the UK's competitiveness and drive up levels of innovation. That is why the Government set out an ambitious ten-year strategy to maximise the effectiveness of the UK's science and innovation system, in partnership with business.

1.3 Overall, the third annual report concludes that, three years into implementation of the ten-year framework, good progress is being made in delivering the programme. From an already strong position, the UK research base continues to improve, helped by rising public investment. Knowledge transfer activity from the research base continues to increase, and there are also encouraging signs that attainment and take-up for STEM skills are beginning to improve. However, while business investment in R&D is growing in real terms, making more rapid progress in raising levels of business innovation across all sectors and accelerating the translation of excellent research into new goods and services remains a key challenge.

1.4 Responding to this challenge will increasingly be the focus of the Government's strategy over the coming years, and the ten-year framework must adapt accordingly. Some important policy measures have already been introduced since the ten-year framework was published in order to further improve the environment for innovation, and were set out in *Next Steps*, and include the reform of research assessment; a new strategy for health research; and further action on STEM skills. Building on this, the past year has seen a number of developments which mean that there is now an opportunity to deliver a step change in the impact of the Government's policies to raise the UK's innovation performance:

- in November the Chancellor asked Lord Sainsbury to take a forward look at what more needs to be done to ensure the UK's continued success in wealth creation and scientific policy-making. Building on the ten-year framework and *Next Steps*, the Sainsbury Review is undertaking an in-depth analysis of the UK innovation system, identifying a number of important areas where further action is needed (See Box 1.1 for further details). The review, due to be published later in the year, will provide a major input into the Government's future science and innovation policies;

[1] World class research, Responsiveness to the needs of the economy, Business R&D and innovation, Supply of scientists, Public understanding and engagement, Science and innovation across Government.

- the creation of a new Department for Innovation, Universities and Skills (DIUS) in June 2007 brings together policy on skills, higher Education, science and innovation for the first time, and offers a major opportunity to deliver an integrated approach to these key drivers of economic growth. DIUS will be responsible for driving forward delivery of the Government's long-term vision to make Britain one of the best places in the world for science, research and innovation, and a key priority of the new department will be to respond to the recommendations of the Sainsbury Review. DIUS will also work closely with the new Department for Business, Enterprise and Regulatory Reform (BERR) to further improve the environment for knowledge-intensive businesses in the UK;

- the Government welcomed Sir David Cooksey's *Review of UK Health Research Funding* in December 2006 and is taking the recommendations forward, including the creation of a new Office for the Strategic Coordination of Health Research (OSCHR). This will create a single health research strategy for the UK, cementing the UK's leadership in this area and providing improved support for clinical and translational research. Budget 2007 announced further details of how OSCHR will operate;

- Budget 2007 announced early Comprehensive Spending Review (CSR) settlements for the Department of Trade and Industry (DTI) science budget and for the Department of Education and Skills (DfES), which together ensure that public investment in the science base will rise by an annual average real rate of 2.5 per cent over the CSR period. These settlements (which will now be delivered through DIUS) provide long-term certainty for the research community, and will underpin the priorities outlined elsewhere in this report, including implementation of the Sainsbury and Cooksey reviews;

- building on the emerging recommendations of the Sainsbury Review, the Technology Strategy Board (TSB) came into operation as an executive non-departmental public body (NDPB) from 1 July 2007, with an enhanced leadership role to promote innovation across all sectors of the UK economy. In support of this enhanced role, Budget 2007 announced that the Research Councils will set specific targets for the amount of R&D they conduct in partnership with the TSB.

Encouraging signs of progress

1.5 Together, these reforms will significantly improve the effectiveness and strategic coordination of the UK's innovation system, and set the context for the next phase of delivery for the ten-year framework, building on the progress achieved so far. Further achievements over the past year are summarised below.

World class research

1.6 UK researchers are the most efficient and productive in the world. The latest report to the DTI on the performance of the research base[2] also showed the UK increased its share of the most influential research papers and the number of key disciplines in which it leads the world.

[2] PSA target metrics for the UK research base, March 2007. Available at http://www.dti.gov.uk/files/file38817.pdf .

Improved financial sustainability

1.7 Following the sustained programme of capital investment provided by the Science Research Investment Fund (SRIF), a report on the future needs for capital investment in universities[3] found that the backlog had reduced by more than half its 2001 value, and is on course to reach a level that is manageable on an ongoing basis by the end of this year, with those backlogs that remain no longer inhibiting research.

Greater responsiveness

1.8 The positive trend in knowledge transfer is continuing with collaborations between researchers and business increasing. The Higher Education – Business Community Interaction (HE-BCI) survey showed that income from consultancy and Intellectual Property (IP) licensing has increased, and the number of spinouts is also showing an increase. The third year of the Public Sector Research Establishments (PSREs) survey of knowledge transfer showed similar trends, including a very significant increase in licensing activity. The Research Council's *Increasing the Economic Impact of the Research Councils* Report was published in July 2006 and recognises that Research Councils are increasing their emphasis on knowledge transfer whilst maintaining their research excellence.

Supply of scientists

1.9 There has been an encouraging rise in the proportion of young people reaching expected levels in mathematics and sciences. Applications to study STEM subjects including Chemistry and Physics at undergraduate level are also showing substantial increases this year. Proposals announced in May 2007 will see a national campaign to promote STEM careers running from September 2008.

Increased business investment and engagement

1.10 The performance of the Technology Strategy Board will be a key factor in driving up future levels of UK innovation performance. R&D Tax credits have proved very popular and Budget 2007 announced measures to enhance them further. Whilst Business Expenditure on Research and Development (BERD) grew in real terms in 2005 (the latest year for which figures are available), and kept pace with growth in GDP, it has yet to recover from the decline relative to GDP growth seen since 1990. As the data available moves forward into the period covered by the framework, improvement will be needed to provide progress towards the combined 2.5 per cent GDP research expenditure target. This undoubtedly remains a challenging goal.

Global partnerships

1.11 The Global Science and Innovation Forum (GSIF) published its strategy for international engagement in research and development in October 2006. The strategy sets out a number of recommendations for action across the Forum's membership and provides a context for the range of activities they undertake - across government and more widely – to ensure the UK can take advantage of emerging international opportunities and respond to challenges.

Public engagement

1.12 The Sciencewise Programme has a new focus on projects directly linked to key issues such as stem cells and brain science; and *sciencehorizons*, the first ever mass public engagement programme about how science and technology could affect our lives in the next 15-20 years, has been established.

[3] Future needs for capital grant funding in Higher Education: a review of the future of SRIF and Learning and Teaching capital, JM Consulting, 2006

Science across government

1.13 The Government has continued to build on the steps highlighted in last year's Annual Report to ensure sustained improvement in the Government's management and use of science and innovation, such as the rolling programme of Science Reviews, the work of the Chief Scientific Advisers Committee (CSAC), the independent Council for Science and Technology (CST) and the Horizon Scanning Centre (HSC). Additionally the Government Response to the House of Commons Science and Technology Committee Inquiry on Scientific Advice, Risk and Evidence Based Policy Making led to a thorough review of progress across a very wide range of policy areas.

Economic Impact Framework

1.14 DIUS, in consultation with a wide range of stakeholders including HM Treasury academics and business developed a new Economic Impact Framework to provide a unified approach to monitoring progress against the ambitions of the ten-year framework. Building on existing work and seeking to fill the gaps in innovation and translational monitoring identified in last year's report, this replaces the *Science and Innovation Investment Framework : Progress against Indicators* and is published as an Appendix to this report at http://www.dti.gov.uk/science/science-funding/framework/page9306.html.

Box 1.1: Sainsbury Review

In November 2006 the Chancellor asked Lord Sainsbury the former Minister of Science and Innovation to conduct an independent review of the UK Science and Innovation system.

The terms of reference for the Review were to take stock of the response of the UK Science and Innovation System to the challenges and opportunities of globalisation, and to take a forward look at what needs to be done to ensure UK success in wealth creation and scientific policy-making, focusing on:

- Industry R&D and investment in innovation;
- publicly funded R&D and investment in innovation;
- knowledge exchange between universities and business, including examining progress made since the Lambert Review;
- R&D policies of Government Departments;
- the supply of skilled people;
- the supply of Venture Capital;
- Patents, Measurement System and Standards; and
- international science and technology collaboration;

Some of the emerging themes of the Review were set out in Budget 2007, and include: an enhanced role for the TSB in delivering support for technology-based business innovation; further measures to improve the recruitment and retention of STEM teachers and the provision of careers advice; improving the effectiveness of support for knowledge transfer through the Higher Education Innovation Fund (HEIF); enhancing departmental R&D and procurement to drive innovation, including through the use of Innovation Platforms and reforms to the Small Business Research Initiative (SBRI); building on the Regional Development Agency (RDA) focus on science and innovation to drive up regional economic growth; and further steps to encourage global research collaboration.

The Review will publish its findings later in the year.

2 RESEARCH EXCELLENCE

This chapter outlines key achievements and actions to maintain and improve the international competitiveness of UK research and improve its long-term sustainability, including:

- continued improvement in the performance of the UK research base in terms of quality, productivity and efficiency; on some indicators of research impact the UK has moved into first place over the last two years despite increasing competition from India and China;
- the investment backlog in university research infrastructure is on course to be reduced to a manageable level by 2008, marking a major milestone in returning the research base to a sustainable condition;
- the Diamond Synchrotron, the largest scientific facility to be constructed in the UK for 30 years, was completed and received its first users in a live running environment;
- the Science and Technology Facilities Council (STFC) was established in April 2007, merging CCLRC and PPARC to provide a more integrated approach to the management of large scientific facilities;
- the Global Science and Innovation Forum (GSIF) strategy has been published and is now being implemented to promote the UK's scientific strengths at the international level.

2.1 Ambitions relating to research excellence and sustainability for UK science and innovation were outlined in the ten-year framework as follows:

World class research at the UK's strongest centres of excellence:

- maintain overall ranking as second to the USA on research excellence, and current lead against the rest of the OECD; close gap with leading two nations where current UK performance is third or lower; and maintain UK lead in productivity; and
- retain and build sufficient world class centres of research excellence, departments as well as broadly based leading universities, to support growth in its share of internationally mobile R&D investment and highly skilled people.

Sustainable and financially robust universities and research institutes across the UK:

- ensure sustainability in research funding accompanied by demonstration by universities and public laboratories of robust financial management to achieve sustainable levels of research activity and investment.

2.2 To achieve these ambitions, the 2004 Spending Review allocated over £1 billion in additional funding for the research base up to 2007-08, including funding to enable Research Councils to cover a greater share of the full economic costs of research and continued dedicated capital funding for the renewal of university infrastructure. The CSR settlement announced for the science budget in Budget 2007 continues the Government's record of sustained and rising investment in the research base, and will see the Science Budget increasing by 2.7 per cent in real terms over the CSR period.

EVIDENCE OF PROGRESS

2.3 The fourth independent annual report on the performance of the UK research base revealed continued improvement from an already strong position. The UK has increased its share of highly cited papers to 13.3 per cent, and the proportion of uncited papers produced by the UK continued to fall. The UK has also sustained a more consistent performance across the range of scientific disciplines than most other countries and retains its lead in the G8 on productivity measures. China is making unprecedented levels of investment in science and is rapidly increasing its global share of publications and citations but this study shows that the UK continues to maintain its world share in the face of intensifying competition. For more details see http://www.dti.gov.uk /files/file38817.pdf .

Table 2.1: PSA target metrics for the UK research base[4]

Research field	World ranking	Trend 96-05	Highlights
Bioscience	2	↔	• UK increasing overall citation and highly cited share.
Business	2	↑	• UK very high on citation "productivity".
Clinical	2	↑	• Agile research base – second in seven out of ten broad research disciplines
Environmental sciences	2	↔	
Humanities	2	↔	
Pre-clinical	2	↔	
Social sciences	3	↑	
Mathematics	4	↔	
Physical sciences	4	↑	
Engineering	4	↔	

[4] Data reflects UK number and share of world citations in ten major research fields.

KEY HIGHLIGHTS

World-class research

Research Assessment Exercise (RAE) – Next Steps

2.4 In *Science and Innovation Investment Framework 2004-2014: Next Steps,* the Government announced its intention to move to a simplified new quality assessment system that would make greater use of metrics for science-based subjects after the 2008 RAE, and ensure that excellent research of all types are rewarded, including user-focused and interdisciplinary research. As last year's Annual Report went to press, a consultation was in progress on initial proposals for metrics-based arrangements. The consultation received responses from around 300 institutions, organisations and individuals, and the Government issued further proposals, broadly welcomed by the sector, alongside December's Pre-Budget report. The new arrangements keep quality at the heart of the assessment process and recognise differences between subjects in the readiness and applicability of metrics within a common overall framework.

2.5 The first assessment under the new arrangements for science, engineering, technology and medicine subjects will take place in 2009, and will use a basket of indicators, including external research income, student numbers and bibliometric indicators. The new arrangements will begin to inform QR funding in England from 2010-11. For other subjects – where bibliometrics are not currently a widely acceptable indicator – the first assessment under a light-touch peer review process will take place in 2014.

Financial Sustainability

Science Research Investment Fund (SRIF)

2.6 In September 2006 an independent study jointly commissioned by DTI and the UK higher education funding bodies looked at the future need for infrastructure funding. It concluded that the backlog in research infrastructure investment had halved since 2001 and was on course to reduce to a manageable level in the near future. The backlogs that remained were no longer inhibiting necessary teaching and research, but were rather affecting efficiency, strategic positioning and potential for growth. SRIF has been the driving force in achieving this through a direct contribution to investment of over £3 billion, it has also helped universities develop a more strategic approach to capital investment planning. A new capital funding stream is being developed as a replacement to SRIF, to focus on future needs and help ensure that the investment backlog does not reoccur. Details of the new funding stream will be announced later in the year.

Case Study 2a SRIF : Oxford University Begbroke Science Park

The SRIF investment in infrastructure has enabled the site to double in developed area, allowing additional materials engineering research to relocate from the town centre to Begbroke, thereby consolidating research effort in one location.

The Oxford Supercomputer can also now be supported at Begbroke which would have been impossible with the previous microwave link. Now a 48 core fibre runs from the site to the town centre. This gives the academics the IT capacity required to transmit research data freely. The Supercomputer will handle more than a million million calculations a second and will speed up complex data analysis considerably.

SRIF funding has been used to construct a new multi disciplinary applied research facility, the Institute of Advanced Technology (IAT). It is the IAT which will house the Supercomputer, along with research groups from 6 different Maths, Physical and Life Science Departments. This is the first truly multi-disciplinary research facility at Oxford and will bring together work in nanotechnology, photovoltaics, environmental microbiology, environmental pollution management, water research, impact engineering and chemical catalysis.

Full Economic Costing (FEC)

2.7 The National Audit Office (NAO) carried out a review of the implementation of the implementation of FEC by the Research Councils and Universities. The NAO reported that 'To date the project can be considered a success' and highlighted a number of areas of good practice. It is still relatively early in the implementation process to see the full benefits of FEC: at the end of 2006/7 about a third of the total Research Councils grant portfolio was funded on the basis of 80 per cent FEC, and the whole portfolio will be funded on this basis by 2010/11.

Public Sector Research Establishments (PSREs)

2.8 The second annual monitoring report on the sustainability of PSREs was published in July 2007 – this monitoring exercise helps research organisations in the public sector, and their parent departments, assess their long term financial sustainability. The report shows some improvement overall in the level of sustainability of PSREs, but also notes that there are still some establishments where action is needed to ensure they can maintain their delivery of service.

Large facilities

2.9 The Science and Technology Facilities Council (STFC) was established on 1st April 2007. This new Research Council brings together the activities previously covered by the Council for the Central Laboratory of the Research Councils (CCLRC) and the particle Physics and Astronomy Research Council (PPARC) with the addition of support for nuclear physics, which has been transferred from the Engineering and Physical Sciences Research Council (EPSRC). The budget for 2007/08 is £610 million. The new Council was established to create a more integrated approach to large facilities including international negotiations, to obtain more value from the knowledge and technologies developed by the new Council, and to take forward the development of the two national science and innovation campuses at Harwell (with UKAEA) and Daresbury. More information on STFC can be found at http://www.stfc.ac.uk/Home.aspx.

Diamond

2.10 The Diamond Synchrotron is the largest science facility to be constructed in the UK in the last 30 years, and can be described as a series of "super microscopes". It is housed in a futuristic doughnut-shaped building at Harwell in Oxfordshire which covers an area of 5 football pitches. Diamond will ultimately host up to 40 research stations, called beamlines, supporting the life, physical and environmental sciences. It opened its doors to its first users in February 2007. From a total of 127 proposals across the synchrotron user community, academic teams from Durham, Oxford, Leicester and London were selected to be the first users. The facility was delivered, on time, to budget and to specification. This Phase I investment was funded by £260 million from the UK Government (86 per cent) via STFC and the Wellcome Trust (14 per cent).

Big Science

2.11 In January 2007 the NAO published a report *Big Science: Public Investment in Large Facilities*. The report concluded that the current arrangements should deliver a significant contribution to the development of the nation's infrastructure, but, made a number of recommendations relating to further improvement of the planning and delivery of such facilities. In response to the NAO recommendations, DIUS and Research Councils have established a Working Group to take forward the recommendations in advance of the publication of the 2007 Large Facilities Roadmap and the Large Facilities Capital Fund (LFCF) allocation process. This will include greater emphasis on consultation with stakeholders on the Roadmap, a greater emphasis on the economic impact of facilities and the development of clearer guidance to those proposing projects.

Case Study 2b : RRS James Cook

The DIUS Large Facilities Capital Fund (LFCF) provided £25 million of funding to the Natural Environment Research Council (NERC) to help fund a new research vessel - the Royal Research Ship James Cook. This new oceanographic research ship was delivered by the shipbuilder to NERC in August 2006, on time and within budget. The provision of LFCF funding followed prioritisation by Research Councils UK (RCUK) of the projects listed in their Large Facilities 'Roadmap'. The remainder of the project cost was met by NERC. The RRS James Cook will operate worldwide from the tropics to the edge of the ice sheets and undertake both continental margin and deep ocean projects. It will allow big multidisciplinary teams to be brought together at sea and will be used to address some of the challenging questions facing marine scientists – particularly the oceans' role in climate change and the unexplored deep ocean frontiers. The ship's design will enable it to work in higher sea-states than the Research Council's existing dedicated research vessels. Its maiden voyage was in March 2007 to the Mid Atlantic Ridge, a massive underwater volcanic mountain range.

Supporting world-class health research

2.12 Sir David Cooksey published his report on UK Health Research Funding on 6 December 2006 alongside the Pre Budget Report. The Government accepted his recommendation to establish a central coordinating mechanism, the Office for Strategic Coordination of Health Research (OSCHR), to work with the Medical Research Council (MRC) and the Department of Health (DH) to facilitate more effective translation of health research into health and economic benefits for the UK. The key functions of OSCHR will be to:

- work with officials from DH, DIUS and the Devolved Administrations to set the Government's health research strategy, taking into account the advice, priorities, and needs set out by the National Institute for Health Research (NIHR) and its equivalents in the Devolved Administrations, MRC and the NHS;
- set the budget required to deliver the strategy and objectives for DH and MRC, including the distribution of the budget between NIHR and MRC;
- submit to HM Treasury a single funding bid for the agreed strategy;
- monitor delivery of the strategy against objectives, to report to ministers and Parliament on its progress, and to advise ministers on the effectiveness of maintaining two separate public research bodies; and
- encourage a stronger partnership with the health industries and charities.

OSCHR

2.13 John Bell, the Chair of OSCHR, has established an Interim Oversight Group (IOG) to assist him in establishing the new body. This has helped him prepare priorities for the CSR and to develop plans for the Translational Medicine Board and Public Health Research Board, through which OSCHR will operate. Working with OSCHR, DH and MRC have established three working groups to develop a detailed strategy for experimental medicine, methodology, and clinical trials/ evaluation.

Global Partnerships

Global Science and Innovation Forum (GSIF)

2.14 The cross-government Global Science and Innovation Forum (GSIF)[5] published its strategy for international engagement in research and development in October 2006[6]. The GSIF strategy sets out a framework of objectives to prioritise and coordinate the UK's international engagement in R&D under the themes of research excellence, excellence in innovation, the use of science and technology to support wider foreign policy goals and using research and innovation in support of international development goals. The strategy recognises that engagement in international science and innovation is a fast-moving and dynamic area and sets out recommendations in a number of key areas:

- ensuring UK researchers and businesses engage with the very best research internationally, through simplified access to public support schemes and by creating a single RCUK presence in key partner countries;
- developing strategic partnerships, through Science Bridges to link world class UK universities with counterparts in China and India, in order to attract the best researchers to the UK and to establish with the Royal Society an effective alumni fellowship scheme;
- improving coordination to create synergies across government and key non-governmental bodies - in bilateral relationships with priority countries, in marketing and communicating UK strengths, and in promoting the use of scientific advice in policy making; and

[5] member organisations are DIUS, FCO, UKTI, HMT, Defra, DFID, DIUS, Department of Health, Home Office, Royal Society, British Council and Research Councils

[6] http://www.dti.gov.uk/files/file34726.pdf

- supporting activities to increase the innovative nature of UK business - ensuring it has the capacity to internationalise and has access to the very best science, engineering and technology opportunities worldwide; and increasing the research intensity of the UK by encouraging R&D investment in the UK by innovative multinational enterprises, working with UKTI.

2.15 Work has been ongoing across the membership of GSIF to deliver these recommendations.

EU Framework Programme

2.16 The UK played a major part in shaping the European Union's Seventh R&D Framework Programme (FP7) launched in December 2006, following an intense period of negotiation. The programme will cover the period 2007-2013 and have a budget of €53 billion. The UK was successful in negotiating an increase in reimbursement rates in FP7; public bodies, universities and SMEs are now able to claim up to a maximum of 75 per cent of their eligible costs for Research and Technological Development (RTD).

European Research Council (ERC)

2.17 As part of FP7 a new European Research Council (ERC) was launched in February 2007 under the leadership of an autonomous Scientific Council and with a budget of €7.5 billion to boost excellence and creativity in basic research across the EU.

Joint Technology Initiatives

2.18 A new aspect of FP7 is the launch of Joint Technology Initiatives (JTIs) major public private partnerships to invest in industrially-driven research in key technologies. The UK has strong interests in the proposed initiatives in innovative medicines (with a proposed budget of €2 billion) and in aeronautics (with a proposed budget of €1.7 billion), and is seeking rapid legislative decisions in order for these initiatives to be launched as soon as possible.

Bilateral relationships

2.19 International science and innovation partnerships were further developed over the year.

2.20 The first Indo-UK Science and Innovation Council, held in June 2007 made significant progress on the UK/India Education and Research Initiative (UKIERI) – a five-year, £14 million initiative to improve education and research links between India and the UK – which was further boosted by India's Department of Science and Technology pledging up to £8 million for science-based applications. Joint Commission's were also held with China, Japan and Korea to discuss priority areas for future collaboration.

2.21 The UK-Brazil Year of Science was launched in March 2007. Its objectives are to promote awareness in Brazil of UK excellence in science and innovation; to strengthen and increase collaboration between the two countries; to share best practice in science-based policy-making; and to facilitate high-tech trade and investment links between the UK and Brazil. A comprehensive programme of delegations, visits, workshops and events, will be delivered over the coming year.

Research for development

2.22 Progress was made through the Carnegie Group of G8 Science Ministers/Advisers on the "science for African development" agenda. The OSI also funded a post within the newly formed OSI/DfES/Association of Commonwealth Universities Africa Unit, in response to the higher education and research recommendations in the Commission for Africa report. The UK Collaborative on Development Sciences (UK-CDS) will become operational in 2007.

3 GREATER RESPONSIVENESS TO THE NEEDS OF THE ECONOMY

This chapter highlights key achievements over the past year to increase knowledge transfer and innovation from universities and research institutes. In particular:

- continued growth in engagement between the research base and business, showing the increasing ability of researchers to exploit the fruits of their research;
- new commitments by the Research Councils to deliver a major increase in the economic impact of their research; and
- growth in the exploitation of research from Public Sector Research Establishments especially in terms of licensing.

3.1 The 2003 Lambert Review of business-university collaboration concluded that the UK science base performs well in international comparison, but has been less effective at translating the products of research into social and economic benefits. The ten-year framework set out to encourage greater responsiveness of the publicly-funded research base to the needs of the economy and public services, focusing specifically on two targets:

- improve UK performance in knowledge transfer and commercialisation for universities and public laboratories to world leading benchmarks; and
- Research Councils' programmes to be more strongly influenced by, and delivered in partnership with, end users of research.

3.2 The ten-year framework included the Government's response to the Lambert review and announced increased support for knowledge transfer from universities in England through the Higher Education Innovation Fund (HEIF).

EVIDENCE OF PROGRESS

HE-BCI

3.3 The Higher Education – Business Community Interaction (HE-BCI) survey, helps to assess the volume and development of interaction between higher education, business and the wider community.

Growth in licensing and IP

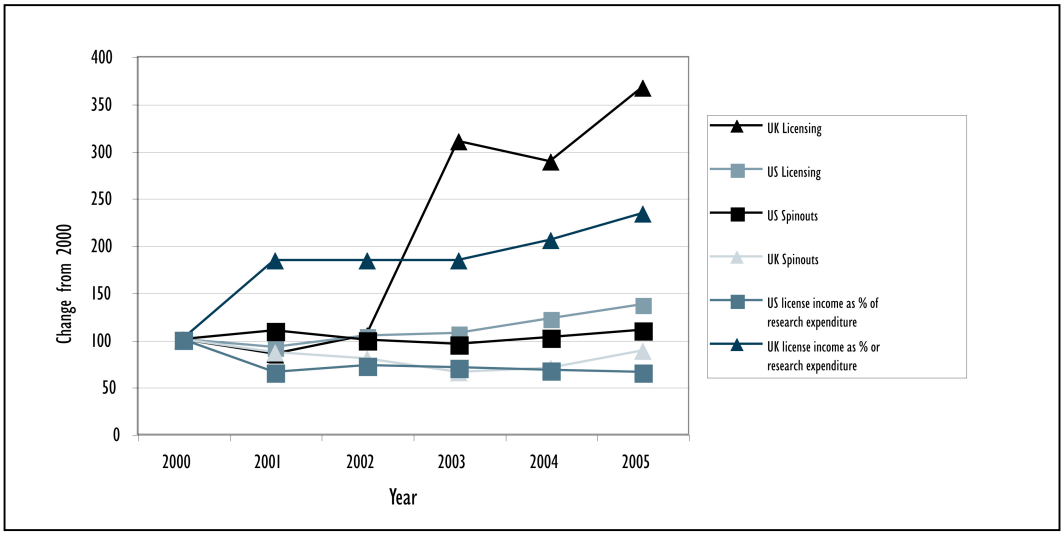
3.4 The latest survey results reveal continuing positive trends in knowledge transfer activities (baseline taken as 2000-01). The number of new patents applied for, income from licensing, the number of licensing agreements and income from businesses through consultancy all continue to grow. However, although the number of spinouts has increased for 2005-6 these are still 25 per cent down on 2000-01 figures. This suggests that HEIs are focusing on quality rather than quantity of spin-outs, recognising that the likelihood of success and financial returns are often greater for licenses than for spinouts.

Table 3.1: Higher Education Business Community Interaction (HEBCI) Survey Indicators

Indicator - HEIs	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Number of new patent applications filed by Higher Education Institutes (HEIs)	896	960	1,222	1,308	1,649	1,537
Number of Patents granted	250	198	377	463	711	576
Number of licensing agreements	728	615	758	2,256	2,099	2,699
Income from licensing intellectual property (£ million)	18	47	37	38	57	58
Number of spin-outs	248	213	197	161	148	187
Income from business (value of consultancy contracts) (£ million)	104	122	168	211	219	236
Number of full time equivalent staff employed in commercialisation/industrial liaison offices	1,538	1,836	2,283	2,706	3077	3448

3.5 Chart 3.1 (below) shows the comparison between the UK and US for licensing, spinouts and license income (as a percentage of research expenditure). A baseline of 100 has been used to allow for comparisons in trends between the US and UK. Since 2000, the number of licenses and licensing income in the UK have both increased significantly compared to the US. Spinouts for both US and UK had a downturn in 2003, but both have started to show increased numbers in 2005.

Chart 3.1: Relative changes in US and UK indicators



Gowers Review

3.6 The Gowers Review of the Intellectual Property (IP) Framework, published in December 2006, found the IP system to be performing broadly satisfactorily and made a number of recommendations with the aim of reducing costs to business; making the IP system clearer and fairer for consumers and other users; and improving the enforcement regime. Responsibility for implementation of the majority of the recommendations lies with the UK Intellectual Property Office (UK-IPO) and it is the Government's objective to implement the majority of the recommendations by the end of 2008. The Gowers Review highlighted the importance of supporting the creative industries through tackling IP Crime. IP crime has already been recognised as an area for Police action in the updated National Community Safety Plan. Trading Standards Officers received powers to enforce copyright offences from April 2007, and £5 million has been made available to local government to fund this function in the first year.

IP Protection

3.7 The Government is also committed to providing greater support to UK business to help recognise, protect and maximise the value of their intellectual property, including through a pilot scheme offering IP health checks to small businesses. The pilot is part of the UK-IPO's Innovation Support Strategy and commenced in March. It will run through to the end of December 2007.

Patent Prosecution Highway

3.8 The UK-IPO and Japanese Patent Office are trialling a new initiative, the Patent Prosecution Highway, which allows accelerated examination of a patent application where examination has already taken place in the other country. In addition to speeding up the patenting process for UK businesses in Japan, the initiative will help promote work sharing between patent offices around the world, thereby reducing costly duplication of effort. A similar arrangement is being negotiated with the USPTO.

Lambert tool-kit

3.9 The Lambert IP tool-kit is showing increasing and effective usage in business-university collaborations and the Lambert group is working towards extending the tool kit for multi-partner research consortia. A one year review indicated that take-up of the model agreements has been positive in both public sector research organisations and industry. The Association for University Research and Industry Links (AURIL) reported that 72 per cent of their responding members believed the agreements have simplified contract formation, providing savings in time and money. UK healthcare giant GlaxoSmithKline reported using the panel of five agreements in fifty nine partnerships, including ten overseas collaborations.

KEY HIGHLIGHTS AND NEXT STEPS

Higher Education Innovation Fund (HEIF)

3.10 HEIF promotes knowledge transfer and engagement with business, and has played a key role in embedding these activities in universities. The current round of HEIF provides £238 million over the 2006/7 – 2007/8 spending period. HEIF has provided a number of examples of how the academic community and businesses in the UK have worked together to produce new and innovative products and services that have a significant impact on the UK's economy. The Sainsbury Review is currently developing recommendations on the future of HEIF.

SETsquared	Four universities – Bath, Bristol, Southampton and Surrey – work as a consortium to deliver the whole range of their academic enterprise agenda, with eight main elements of work; enterprise education, professional/personal development, networking clusters and sectors, knowledge transfer through people, business development through consultancy and project management, IP management, new company development and incubation..
Combined Universities in Cornwall	Part of a coherent business support strategy across the higher education sector in Cornwall. There is a particular focus on incubation support, linking new pre-incubation facilities at University College Falmouth with the Knowledge Spa incubation facility at the Peninsula Medical School, Treliske. This project builds upon existing business support activity in art, design and media, establishing a new 3D design bureau, additional art/design projects, a professional writing centre, and employability support for graduating artists. The environmental and Earth sciences sector is supported with mentoring, R&D support, and environmental projects.
Knowledge Capital Universities - Manchester	This knowledge transfer collaboration brings together Manchester Metropolitan, the University of Manchester and Salford University to support the 'Knowledge Capital' prospectus. Development projects will improve access to research expertise within the HEIs. Business development work will help with sharing of commercialisation expertise; additional support for Knowledge Transfer Partnerships; feasibility and pilot work within the city; academic inward investment; cultural industries; area regeneration. Skills initiatives will improve development of entrepreneurial talent.

Research Councils Knowledge Transfer Plans

3.11 As part of the response to the separate RCUK and House of Commons Science & Technology Committee reviews of Research Councils' effectiveness in knowledge transfer, the Director General of Science and Innovation, Sir Keith O'Nions, asked Peter Warry to lead an Economic Impact Group to make recommendations on how Research Councils could deliver - and demonstrate that they are delivering - a major increase in the economic impact of their investments.

3.12 The report was published in July 2006 with four key recommendations for Research Councils:

- improving leadership of the knowledge transfer agenda across the Research Councils;
- strengthening the role of the Research Councils in influencing the knowledge transfer behaviour of universities and Research Council Institutes;
- increasing their engagement with user organisations; and
- demonstrating more clearly the impact they already achieve from their investments.

3.13 The report recognised that Research Councils have pivotal roles, both as funding bodies and as leaders of the research base. It added that Research Councils are already increasing their emphasis on knowledge transfer and the economic impact of their work but must increase this emphasis further without sacrificing research excellence.

3.14 Research Councils UK published their *Economic Impact Action Plan* in January 2007. Commitments include a biennial user satisfaction survey, an economic impact study, a project to improve the coordination and collective presentation of Research Council support for knowledge transfer and a knowledge transfer summit. The full action plan is available at: http://www.rcuk.ac.uk/aboutrcuk/publications/policy/ktactionplan.htm.

3.15 The commitment of the Research Councils to delivering a step-change in economic impact will be demonstrated through their delivery plans for the next CSR Period as part of the CSR allocation process.

3.16 Budget 2007 announced that DIUS will agree specific targets for collaboration between the Research Councils and the Technology Strategy Board (TSB). This builds on the success of existing collaborations, and will deliver a step change in the impact of TSB and Research Council support for business innovation.

Case Study: Blue skies research plugs a leak (EPSRC)

Syrinix (established in 2004) is a commercial spin-out of innovative technology developed by University of East Anglia's School of Computing Sciences, funded through the EPSRC Water, Infrastructure and Treatment Engineering (WITE) initiative. The company has developed signal processing techniques and equipment to detect and locate very small leaks in large-trunk water mains. Detection stops bigger, more devastating leaks from springing up and helps water companies prevent massive loss of water and damage to roads and buildings surrounding the pipes.

Syrinix grew out of blue-skies research funded by EPSRC was named Business Initiative of the Year in the Times Higher Education Supplement 2006 awards.

Public Sector Research Establishment (PSRE) Fund

3.17 The third annual survey of Knowledge Transfer Activities in PSREs was published during the past year. This showed an increase over the three years for which surveys have been run in the number and value of licensing agreements and in spin outs. DIUS has consulted the PSRE community on how the impact of the Public Sector Research Exploitation fund could be maximised. This will lead to an increase in the proportion of the fund being made available to PSREs who lack a track record of commercialisation but have research capable of being exploited.

Table 3.2: PSRE indicators

Indicator - PSREs	2003-04	2004-05	2005-06
Business representatives on governing bodies	175	214	247
FTE staff employed in commercialisation offices	385	368	513
Number of patent applications	316	335	290
Number of patents granted	228	148	193
Number of licencing agreements	621	1,673	1,604
Income from IP licensing	£33m	£46m	£186m
Number of spin-outs	69	84	74
Income from business (consultancy)	£36m	£31m	£26m

Science Cities

3.18 The six Science Cities have worked jointly and separately to develop their strategies, and there is clear evidence of progress in all six, examples of which include:

- Manchester Science City M:KC (Manchester: Knowledge Capital) and the National Endowment for Science, Technology and the Arts (NESTA) have announced the creation of the Innovation Investment Fund – a unique approach to city-level innovation in the UK. The Fund will be targeted at strengthening and developing the innovation environment across the Manchester City Region – increasing the capacity and rate of innovation, and catalysing economic growth. The Fund launches in Summer 2007 and is expected to total £9 million over 3 years; and
- Birmingham Science City has just received funding of £6.3 million from Regional Development Agency Advantage West Midlands to develop the use of hydrogen energy as a green fuel.

4 INCREASED BUSINESS INNOVATION AND R&D

This chapter highlights key achievements and actions to increase business investment and engagement in the last year, including:

- the Technology Strategy Board (TSB) has been made arms-length body, from July 2007, with an enhanced remit to promote innovation across all areas of the economy;
- further improvements to the R&D Tax Credits announced in Budget 2007, to provide stronger incentives for investment in R&D;
- progress in establishing the Energy Technologies Institute (ETI), a 50:50 partnership between business and Government to raise up to £1 billion over ten years for energy R&D.

4.1 In an increasingly knowledge-driven global economy, the countries that thrive will be those who invest in the knowledge and skills required to support the development of innovative new products and services. The UK is home to many world-leading innovative companies, but overall levels of business R&D investment remain low compared to other leading industrialised nations, and some indicators of innovation activity also suggest scope for improvement. This is largely due to the UK's industrial mix : UK companies generally perform well in their sectors, but the UK lacks large R&D-intensive companies in some key sectors such as motor vehicles, IT, and electronics. Nevertheless, raising levels of business innovation and investment in R&D remains a key priority under the ten-year framework.

4.2 The ten-year framework set out ambitions to raise investment in R&D to 2.5 per cent of GDP by 2014 and improve business engagement with the UK science base for ideas and talent:

- increase business investment in R&D as a share of GDP from 1.25 per cent towards a goal of 1.7 per cent over the decade; and
- narrow the gap in business R&D intensity and business innovation performance between the UK and leading EU and US performance in each sector, reflecting the size distribution of companies in the UK.

4.3 As previous chapters have shown, the Government is already making good progress in creating many of the conditions required for increased levels of business innovation, including a world-class science base and better incentives for knowledge transfer between the science base and industry. The establishment of DIUS creates an opportunity to align policies on skills and innovation more closely, in order to deliver the skills base which innovative businesses require to succeed (see Chapter 5 for more details on skills). The ten-year framework also included a number of specific support measures to encourage greater business innovation and investment in R&D, including R&D tax credits and the creation of a business-led Technology Strategy Board (TSB).

EVIDENCE OF PROGRESS

4.4 In 2005, £13.4 billion was spent on total R&D performed in UK businesses. In real terms this was a 3 per cent increase on 2004 (5 per cent increase in cash terms)

- in real terms civil Business Expenditure on R&D (BERD) increased by 2 per cent from 2004 to 2005, while defence BERD rose by 8 per cent ;
- BERD as a proportion of GDP was 1.08 per cent in 2005, arresting the decline seen in recent years; and
- overseas funding of BERD increased in 2005 by 19 per cent in real terms to £3.6 billion. This represents 27 per cent of the total R&D spend in UK businesses.

4.5 It is important to note that due to inevitable time lags this data, while the most recent available, cannot fully reflect the impacts of the policies set out in the ten-year framework. However, there is some evidence that the UK's wider innovation performance – which is harder to measure than R&D, but includes the effect of things like design and business model innovation – may be rather better than the R&D statistics suggest.

The Government's strategy for supporting business R&D investment in the UK is based around four priorities:

- maintaining or growing R&D in sectors where the UK is strong;
- attracting more R&D investment to the UK from abroad;
- increasing R&D intensity in firms or sectors that are lagging behind their peers; and
- creating new R&D intensive sectors through the creation and growth of R&D intensive SMEs.

4.6 The past year has seen a number of reforms to improve further the UK environment for business R&D and make progress against these priorities, including an enhanced role for the Technology Strategy Board; increases to the value of the R&D tax credit; and a new strategy to promote the UK as a location for global R&D investment.

KEY HIGHLIGHTS AND NEXT STEPS

Technology Strategy Board (TSB)

4.7 The business-led Technology Strategy Board (TSB) has a key role in supporting business R&D and innovation, and identifying investment priorities in emerging areas of technology which have the potential to drive future economic growth.

4.8 The Technology Strategy Board has supported eight Collaborative R&D competitions announced to date with two new competitions announced in the last twelve months, £50 million in November 2006 and £100 million in April 2007. Over 600 Collaborative R&D projects are currently being supported with a combined business and Government investment of over £900M (£465 million committed by business and £435 million committed in Government support). The TSB has also progressed the two pilot Innovation Platforms. The Network Security Innovation Platform with support from the Economic and Social Research Council (ESRC), the Identity and Passport Service and the Home Office Scientific Development Branch and the Intelligent Transport Systems and Service Innovation Platform with EPSRC & the Department for Transport (DfT). Innovation Platforms bring together a range of technology and innovation activities to address a major societal challenge. The aim is then to stimulate business investment in R&D and innovation through linkages to public procurement activity.

4.9 Building on this success, the Secretary of State for Trade and Industry announced on 1 November 2006 that the TSB would become an executive Non Departmental Public Body (NDPB), giving it greater independence to drive forward the UK's technological innovation priorities. The new body was launched on 1 July, and will take on a wider remit for promoting growth and increased business investment in R&D and innovation across all sectors of the UK economy, from manufacturing to the creative industries. The new body will alert Government to areas where barriers exist to the exploitation of new technologies, and may be asked to put forward recommendations as to how they can be removed, but responsibility for the overall direction of innovation policy will remain with Ministers.

4.10 To support the TSB's enhanced leadership role as an arms-length body, Budget 2007 announced a number of new initiatives to strengthen the impact of the TSB, building on the emerging conclusions of the Sainsbury Review:

- as outlined in Chapter 3, specific targets will be agreed with each Research Council to increase the amount of co-funding with the TSB over the CSR;
- approval in principle for three new Innovation Platforms: Assisted Living, Low Impact Buildings, and Low Carbon Vehicles;
- two further Knowledge Transfer Networks (KTNs) covering Digital Communications and Creative Industries are being developed in addition to the existing 22 networks, extending the TSB's coverage of economic sectors; and
- as part of becoming an Executive NDPB, the TSB will also take over responsibility for Knowledge Transfer Partnerships (KTPs), Nanotechnology Centres and some EU focused activities such as Eureka and the FP7UK National Contact Point service, which provide businesses the opportunity and encouragement to collaborate at a European level.

R&D tax credits

4.11 To provide greater incentive for business investment in R&D, the Government introduced R&D tax credits for SMEs in 2000 and for large companies in 2002. To date, over 23,000 claims have been received, equivalent to over £1.8 billion in support to business. Building on the success of the scheme, increased rates of relief were announced in the 2007 Budget (relief can be offset against profits in the company's corporation tax return). The large companies rate will rise to 130 per cent of qualifying R&D expenditure and, subject to State Aid approval, the SME rate will rise to 175 per cent. The cash credit currently available to loss making SMEs will stay broadly unchanged.

4.12 In November 2006, Government launched a nationwide network of specialist R&D units within HM Revenue & Customs (HMRC) to further improve the consistency of the claims process. The units, which will handle all SME R&D Tax Credit claims, have been welcomed by business and financial intermediaries.

4.13 Alongside the launch of the new units, the DTI, in conjunction with HMRC and HM Treasury, published a brochure of case studies, *Companies' experiences of Applying for R&D tax credits*, which illustrate a range of firms and projects already receiving R&D tax credits and the relative ease of making a claim. The companies offer their own hints and tips for making successful claims and major business organisations have endorsed the publication.

4.14 To improve levels of take-up, there is a continuing programme of promotion and awareness-raising, led by DIUS (formerly DTI) and HMRC, channelled through business and Government organisations, including RDAs and Devolved Administrations, to help companies understand that the credits can apply to workshop-based R&D in design and engineering companies, as well as to R&D in laboratories.

Energy Technologies Institute (ETI)

4.15 The ETI is intended to deliver a stepchange in the funding, strategic direction and outcome of UK energy science and technology and will be fully operational in 2008. It will be a 50:50 public:private partnership, aiming to raise £100 million per year for UK-based energy research, design and development; a total of £1 billion over a ten-year period. BP, Shell, E.ON UK, EDF, Caterpillar and Rolls-Royce have committed to contribute as full members a total of £300 million over ten years. The Institute intends to expand private sector membership further, to take up the Government's commitment to provide up to £50 million per year over a ten-year period. The Institute will provide funding for universities, SMEs and other firms, and international collaborations to accelerate the development and movement of promising technologies from the laboratories to commercial application.

Intelligent Government Procurement

4.16 Transforming Government Procurement, published in January 2007, outlined a new vision for Government procurement (incorporating innovation and sustainability) and the regime required to achieve that vision, based on a more professional Government procurement service, supported by a smaller, higher calibre Office of Government Commerce (OGC).

4.17 This vision includes better linking of future procurement opportunities with the TSB. In particular, the use of Innovation Platforms has the potential to bring forward more innovative solutions at reduced risk, as well as to help UK businesses take advantage of global markets and competitive procurement opportunities.

4.18 The Sustainable Procurement Action Plan, published in March 2007, also identified ways of harnessing public sector purchasing power to make innovative and sustainable solutions more widely available and affordable to others and to help to deliver a low carbon economy. This has been successfully piloted with the procurement of zero waste prison mattresses.

4.19 New guidance for procurers on how to procure innovation is due to be published shortly by OGC and BERR. The Government will look to build on this by ensuring that innovation is central to both the procurement policy framework and the procurement capability reviews.

Small Business Research Initiative (SBRI)

4.20 The overall SBRI target is that Government Departments will procure at least 2.5 per cent of their extramural R&D from small firms In 2005/06, the total Government resources made available for extramural R&D was £2.6 billion. The value of contracts made with SMEs under the SBRI was £225 million, representing nearly 9 per cent of the baseline budget, well in excess of the 2.5 per cent target. The Sainsbury Review is developing recommendations to increase further the impact of the SBRI scheme on innovation in SMEs.

National Standardisation Strategic Framework (NSSF)

4.21 The National Standardisation Strategic Framework (NSSF) programme, funded by DIUS as part of its commitment to innovation and technology, secured a step change in the use of standards and standardisation. In 2006-7, the final phase of the 3 year programme, the NSSF successfully piloted the web based standards information service, which provides businesses with access to simplified standards abstracts.

National Measurement System (NMS)

4.22 The NMS is managed by DIUS and underpins science and innovation by providing the infrastructure through which measurements are traceable to international standards and by delivering the research to keep the UK at the leading edge of measurement technology and instrumentation.

4.23 During the year, the recommendations of a major review of the NMS have been implemented in order to maximise its impact and contribution to the UK economy. This has resulted in a new NMS programme structure, with a greater focus on providing metrology support to promote innovation and to enable exploitation by businesses through knowledge transfer, networking and collaborations. Construction of new laboratory facilities for the National Physical Laboratory (NPL), which delivers the majority of NMS work, is nearing completion and the building should be fully occupied by the end of the year.

Creative Industries

4.24 Creative industries are an important contributor to innovation, and the strategic understanding and exploitation of technology and innovation by the Creative Industries will be vital to their future growth and success. Collaboration and the exchange of knowledge, ideas and opportunities across the Creative Industries and within sub sectors is a key need, and a KTN is being developed in this area to foster collaboration between universities and business; and collaboration for commercial opportunities.

Service Industries

4.25 The services sectors have grown to become a major component of the economy, accounting for over 75 per cent of the UK's GDP by early 2007. However the drivers of innovation in services are not recognised as readily as, for instance, manufacturing investment in research and development. In the light of an increasingly service-orientated economy, BERR has started, in summer 2007, a project on Innovation in Services, in partnership with NESTA. This aims to deepen further understanding of innovation in service sectors; and to assess whether any Government actions should be taken to encourage and facilitate innovation in service sectors or to reduce barriers to this. The project will work on this with a small number of business-led sector innovation groups; as well as joining up with DIUS, the new TSB, and other key stakeholders from Government and the knowledge community. The project aims to generate recommendations to Government, by early 2008, on how to stimulate and support innovation across service sectors to enable them to meet the global challenges of the future.

Animal Rights Extremism

4.26 The Government is committed to taking robust action against extremists who put vital research at risk. By working closely with industry, scientists and enforcement agencies, we continue to support world-class science, including investment in the 3Rs (Replacement, Reduction and Refinement to reduce suffering) and well regulated research and testing using animals where there are no alternatives.

4.27 Government continues to build on the considerable success of its cross-departmental communications strategy tackling animal rights extremism, via media and stakeholder activity - including speeches to stakeholder and public audiences, visits programmes and media articles in a range of national, regional and non-news media.

4.28 Current projects include:

- support for a booklet, *Where do Medicines Come From?*, which puts animal research in the context of the wider drug development process, and will be available in GPs surgeries later in 2007;
- support for a further tour of the play, Every Breath, which encourages balanced debate about animal research and testing amongst secondary school children and production of an accompanying DVD and teaching materials; and
- support for media training events to encourage those working with animals to speak out about animal research and testing.

Skills for Business

4.29 The Skills for Business network of 25 employer-led Sector Skills Councils (SSCs) has been set-up to give employers a stronger voice in shaping the supply of training. SSCs are developing Sector Skills Agreements (SSAs) as the mechanism for employers to work together in identifying and tackling skills needs. Ten SSCs have already launched their SSAs and the remaining 15 are due to launch theirs by the end of 2007.

Global Markets and Foreign Investment in R&D

4.30 UKTI's R&D Programme will target overseas companies to encourage them to undertake (or increase their levels of) R&D in the UK; and work with UK-based R&D intensive companies to increase their R&D output in the UK through international trade and investment activity.

4.31 The Programme is deploying up to 20 technology specialists in business R&D with expertise in key technology sectors[7] to help produce R&D value propositions targeted on expressed company needs. Specialists were appointed at the end of April 2007.

4.32 Recent monitoring survey data indicate substantial positive impact on R&D activity from UKTI trade services with some 10 per cent of companies reporting increased R&D as a result of the support[8]. International marketing strategies will target specific business sectors. UKTI published the financial services strategy document in December 2006. Work is underway on strategies for four other sectors (Creative Industries, Life Sciences, Information and Communication Technologies and Energy), all of which will be completed during the 2007 calendar year.

Cox Review of Creativity in Business

4.33 Sir George Cox's review, Creativity in Business - Building on the UK's strengths, considered how to raise design awareness and its potential benefits for SMEs, and the steps needed to ensure that SMEs are able to draw on the UK's world-leading creative skills. The Design Council, Higher Education Funding Council for England (HEFCE), RDAs, OGC and HM Treasury have taken ownership for the delivery of the specific recommendations of the review and now DIUS will oversee the implementation of the Review's recommendations. Good progress has been made on implementation including:

- **Raising awareness and understanding** - The Design Council's Design for Business programme (now called Designing Demand) is already running in South Yorkshire, South East England Development Agency and Advantage West Midlands regions. Roll-out across all UK regions is expected by end 2008.
- **Preparing future generations of creative specialists and business leaders** - In May 2007, HEFCE awarded funding of £5.8 million towards a centre of excellence. Design-London at RCA-Imperial will create an 'innovation triangle' between design (represented by the Royal College of Art), engineering and technology (represented by Imperial College Faculty of Engineering) and the business of innovation (represented by Imperial's Tanaka Business School). Feasibility funding has also been awarded by HEFCE for development of Northumbria University's Design and Innovation Laboratory.

[7] Life Sciences, Performance Engineering, Materials, Energy & Environment and Information, Telecommunications, Electronics & Communications

[8] UKTI Peformance and Impact Monitoring Surveys http://www.uktradeinvest.co.uk

5 SUPPLY OF SCIENTISTS, ENGINEERS AND TECHNOLOGISTS

The key achievements in ensuring the UK retains a strong supply of scientist, engineers and technologists over the past year include:

- the proportion of 14 year-olds reaching the expected level of competence in mathematics and science reached highest-ever levels in 2006;
- from September, all pupils in England will have an entitlement to study at least two sciences at GCSE, and from September 2008, those who achieve above average Key Stage 3 results will be able to take 3 separate sciences;
- accredited diplomas being piloted to give existing school science teachers without a physics or chemistry specialism deeper subject knowledge;
- 250 science clubs have been established for pupils at Key Stage 3 with an interest and aptitude for science;
- the number of STEM first degree entrants increased by 5 per cent between 2004/05 and 2005/06;
- the number of applications to start first degree courses in 2007/08 is up on the previous year by 12 per cent in Physics, 11 per cent in Chemistry, and 10 per cent in Maths;
- additional funding of £75 million over 3 years to support universities' teaching of high-cost science and engineering subjects; and
- RCUK Research Careers and Diversity Strategy published in January 2007, consultation on principles for a Concordat to Support the Career Management of Researchers published in July 2007.

5.1 The ten-year framework highlighted the importance of a strong supply of scientists, engineers and technologists to the long-term health of the science base and the wider UK economy, and set clear ambitions to achieve a step change in:

- the quality of science teachers and lecturers in every school, college and university, ensuring national targets for teacher training are met;
- the results for students studying at GCSE level;
- the numbers choosing STEM subjects in post-16 education and in higher education;
- the proportion of better qualified students pursuing R&D careers; and
- the proportion of minority ethnic and women participants in higher education.

5.2 Building on the original framework proposals Science and Innovation Investment Framework 2004-2014: Next Steps included a range of further commitments. These aim, notably, to:

- raise further pupil attainment and the quality of school teaching in science and mathematics;

- promote more collaboration between schools and higher education institutions in the teaching and learning of STEM subjects; and
- review and evaluate the changes to the curriculum to ensure science continues to enthuse and inspire pupils.

EVIDENCE OF PROGRESS

5.3 A range of policy reviews have picked up skills issues over the year.

5.4 Lord Leitch's report, published in December 2006 set out recommendations to move the UK's skills base to a higher level, and make education and training more responsive to the needs of employers.

5.5 The STEM Programme report, published in October 2006 announced a new governance structure for STEM policy, with a National STEM Director, a Ministerial Steering Group, a High Level Strategy Group with representation from departmental, agency and other STEM stakeholders and an Advisory Forum to give the wider STEM community ongoing input into policy and delivery. The STEM Advisory Forum was launched in March and is chaired by Sir Brian Follett. John Holman was appointed the National STEM Director.

5.6 Some of the early work of the STEM High Level Strategy Group has been to rationalise the many specialist STEM schemes into a framework of ten schemes for continuing support.

KEY HIGHLIGHTS AND NEXT STEPS

5.7 Key Stage 3 data for 2006 showed that the proportion of pupils reaching the expected level for 14 year-olds in mathematics had risen by 3 percentage points from 2005, to 77 per cent - the highest-ever level. In science, there was a rise of 2 percentage points to 72 per cent - again, the highest-ever level.

5.8 At HE level, the number of STEM first-degree entrants increased by 5 per cent between 2004/05 and 2005/06. Whilst this was lower than the 6 per cent increase in degree entrants overall, all STEM Subjects except Computer Science were up in absolute number terms.

5.9 UCAS figures on applications to start degree courses in 2007/08 are encouraging with increases in double figures for applications to study many STEM subjects, including physics (+ 12.2 per cent); chemistry (+ 11.3 per cent); biology (+6.0 per cent); maths (+10.0 per cent); combined maths/computer science (+15.8 per cent); chemical engineering (+16.8 per cent); civil engineering (+13.0 per cent), and mechanical engineering (+ 9.8 per cent).

Schools

5.10 *Science and Innovation Investment Framework 2004-2014: Next Steps* identified measures to increase the number of qualified STEM teachers, curriculum changes and improvements to careers advice. Over the past year there has been progress in all these areas.

Teacher recruitment

5.11 The Training and Development Agency for Schools (TDA) encourages prospective entrants to teaching to improve their subject knowledge of mathematics, chemistry and physics through pre-ITT enhancement courses in these subjects. The TDA are piloting a continuing professional development programme leading to an accredited diploma to give existing science teachers without a physics or chemistry specialism the deep subject knowledge and pedagogy they need to teach these subjects effectively. The introduction of these courses will increase significantly the overall volume of subject knowledge training being supplied.

Curriculum

5.12 From September 2007, all pupils in England will have an entitlement to study at least two sciences at GCSE, and from September 2008, those who achieve above average Key Stage 3 results will be able to take 3 separate sciences.

After-school clubs

5.13 A £5 million programme launched in March 2007 saw 250 after school science clubs set up across the country to help teachers bring a "real life" dimension to STEM study. The clubs give pupils an opportunity to try out science and technology for themselves through activities and visits to businesses and museums.

Careers

5.14 The HE Minister announced on 16 May 2007 proposals for a national campaign to promote STEM careers, in partnership with subject associations, employers, universities and other stakeholders. The campaign will run from September 2008, and will use common publicity materials, the Science Council's "Careers from Science" website (for which the Government provided £0.5 million) to promote an agreed set of messages to young people, parents and teachers.

5.15 The campaign will be co-ordinated with the broader messages to young people about the new 14-19 curriculum and Diplomas, and is part of a wider programme of action including the appointment of a national STEM careers co-ordinator to co-ordinate information and promotion activities and improve the range and quality of careers information available. Careers information will also be incorporated into the teaching of STEM subjects using resources such as the Science and Engineering Amabssadors' scheme (which brings STEM experts into schools).

Further Education

Recruitment

5.16 The 2006 FE Reform White Paper announced a series of new strategic recruitment processes:

- working with major employers to identify staff looking for a change or a part-time opportunity to come and teach. This is currently being piloted for construction skills;
- a programme looking for people with limited work experience but good degree qualifications to enter a national programme and build a structured career within FE;
- a support package to help colleges recruit senior managers from industry in the colleges sector to bridge the gap between industry and education; and
- a national interchange programme to engage business, the public sector and educational establishments in a dialogue.

Continuing Professional Development (CPD)

5.17 The National Teaching and Learning Change Programme, delivered by the Quality Improvement Agency (QIA), embraces Science, Maths Engineering and ICT. Phase 4, to be launched over the summer, shifts the focus to release additional materials for ICT, Engineering and Construction aimed at engaging existing regional networks.

Curriculum

5.18 The Government, working with the Qualifications and Curriculum Authority (QCA), is reforming vocational learning routes to respond to employers' concerns to tailor the focus of qualifications to employer needs. From 2008, the new 14-19 Diplomas will be introduced, with 14 to be available by 2013 covering the key sectors of the economy. The initial five to be launched in 2008 include Engineering, IT and Construction and the built environment. There are also at present 91 Centres of Vocational Excellence in STEM subjects.

The Leitch Review: implementation

In December 2006 Lord Leitch published his review of the UK's skills needs. It highlighted that though skill levels have improved, the UK must urgently raise skill levels further and set itself a greater ambition to have a world-class skills base by 2020. In the Leitch Implementation Plan for England, World Class Skills published on 18 July, the Government sets out how it will, in partnerships with employers, individuals and unions, raise to Lord Leitch's skills challenge.

The implementation plan sets out the Government's early thinking about how progress towards the Leitch ambitions can be increased at every qualification level, from basic skills to postgraduate qualifications. It also set outs how:

- employers will be placed at the heart of the skills system as part of the Leitch "deal" for increasing their investment in skills;
- government will support and improve workplace skills, increasing the amount of funding that is demand led and improving and extending Train to Gain;
- how individuals will be supported to improve their skills and progress in work, through enhanced careers advice and guidance services and new Skills Accounts;
- the Integration of employment and skills can be driven forward around a shared objective for sustained employment and progression; and
- young people can be better equipped with the skills they need for work and life setting .

It is clear from Lord Leitch's Report that seizing new, global opportunities will require a world-class skills base - both through the expansion of high-end graduate skills and by raising the skills of the wider adult workforce, including those currently unskilled. The Leitch Implementation Plan sets out how Department for Innovation, Universities and Skills (DIUS) will lead work to deliver the Government's long-term vision to make Britain one of the best places in the world for science, research and innovation. It will also lead work to ensure that the nation has the skilled workforce it needs to compete in the global economy.

Higher Education

Strategic subjects

5.19 HEFCE continues to monitor the position of STEM subjects and others of "strategic importance". Its October 2006 progress report noted that the position appeared to have stabilised in respect of STEM subjects (recent applications figures confirm a stabilising or increasing trend). HEFCE awarded around £11.5 million from its Strategic Development Fund to projects to increase and widen participation in engineering, chemistry, physics and mathematics, with subject associations and other partners contributing a further £0.7 million.

5.20 HEFCE also announced additional funding recognising the high costs of some science subjects. From 2007/08, £75 million over 3 years will help maintain provision in subjects including chemistry; physics; chemical engineering; and mineral, metallurgy and materials engineering while student demand grows.

Leitch Review and HE

5.21 The Leitch Review set a challenge for HE: to increase the proportion of people qualified to Level 4 and above from around 29 per cent now to more than 40 per cent (and perhaps as high as 45 per cent) in 2020, including increasing continuing learning towards postgraduate or professional qualifications.

5.22 The review recommended re-balancing HE priorities to include the whole adult workforce in addition to the more traditional group of young entrants, for whom full-time degree courses have been the norm. The 2007 HEFCE grant letter asks HEFCE to support an additional 5000 employer co-funded student places in 2008-09, and will be expected to deliver further growth of at least 5000 additional places year-on-year in each year up to 2010-11.

Strategic Development Fund

5.23 HEFCE's Strategic Development Fund is already supporting an increasing number of institutions in developing employer-focused provision and engagement. Three regional Higher Level Skills Pathfinders are currently being piloted, as we consider how best to drive up and respond to employer engagement and co-funding. Evidence from the pathfinders and engagement projects will inform the development of further collaboration between HE institutions and employers.

Research Careers

Research Careers and Diversity Strategy

5.24 The RCUK Research Careers and Diversity Strategy was published in January 2007, including activities and targets through to 2008 and alongside a brochure entitled A Strategy for Success which highlights the aims of the strategy[9].

Concordat

5.25 A working group of Funders representatives, Universities UK and selected representatives of the sector has established a draft set of principles for *A Concordat to Support the Career Management of Researchers*, designed to replace the 1996 Concordat on the Contract Research Staff Career Management. This will provide a clear, high level, statement of expectations and responsibilities of research funders and institutions with respect to the management of researchers. The draft was published in July 2007 for consultation.

[9] http://www.rcuk.ac.uk/rescareer/strategy.htm

Doctoral Training Accounts (DTAs)

5.26 The Roberts Review, "SET for Success", recommended Doctoral Training Accounts (DTAs) as a good way of achieving flexibility in the length and nature of PhD programmes. The DTA model has continued to develop across Research Councils with EPSRC, MRC and BBSRC providing funding for research students through this route in 2006/07. PPARC and NERC are developing doctoral training grants (DTGs) for studentships from 2007 and 2008 respectively. ESRC has introduced a devolved studentship payment system with block quarterly payments more in line with (but not identical to) the DTA system.

UK GRAD

5.27 The UK GRAD programme, funded by the Research Councils, has been a key vehicle for promoting good practice in the delivery of skills training and building capacity for researcher training within universities. The contract for supporting skills development of researchers (to come into effect from January 2008, following the end of the current UK GRAD contract) will support the higher education sector to develop their provisions for research staff as well as research students. Since the introduction of funding for Career Development and Transferable Skills Training ("Roberts" money), the higher education sector has considerably raised the baseline of researchers' transferable skills, with a third of organisations reporting increasing support for research-only staff.

Enterprise Training

5.28 The Warry Report *Increasing the Economic Impact of the Research Councils* recommended that, as part of their influencing role, Research Councils 'encourage the universities to make enterprise training widely available for researchers in all disciplines.' In 2007, EPSRC allocated money to support enterprise training to institutions with large numbers of Research Council funded researchers. Areas for strengthening researchers' impact on the economy include:

- skills for employability – e.g. entrepreneurship, knowledge transfer, broader technical skills (e.g. quantitative methods), science into policy;
- skills for interdisciplinary working; and
- influencing career flows and public perceptions – outreach to schools and public engagement activities.

Women's Resource Centre (UKRC)

5.29 In the last twelve months, the UK Resource Centre for Women in Science, Engineering and Technology (UKRC)[10] has developed its work with Science, Engineering and Technology (SET) employers. They now have links with over 500 companies looking at the issues of women's recruitment and retention. In March 2007 the UKRC launched the UKRC CEO Charter. This scheme enables company's top management to make a public commitment to actively support the increased participation of women in SET – three companies are already signatories; Atkins Global, BT Openreach and Freescale Seminconductor UK Ltd. 2007 also saw the launch of the UKRC Quality Mark, which showcases 'employers of choice for women in SET'.

5.30 In 2006/07, the UKRC supported a further 200 SET-qualified women looking to return to work through an online training course in partnership with the Open University. Over 500 women have now successfully completed the course; 150 of whom have moved on to employment, training or further study.

5.31 Over 600 women already working in the SET field have registered on the UKRC's GETSET database since its launch in 2006, providing an online resource for organisations looking for women role models or making appointments to public bodies.

[10] http://www.setwomenresource.org.uk/

Athena SWAN

5.32 A further four universities were awarded the Athena Scientific Women's Academic Network (SWAN) Charter in 2006/07. The Athena SWAN charter – a recognition scheme funded by the UKRC, the Equality Challenge Unit and the Royal Society – recognises the commitment of universities, and their science, technology, engineering and maths departments, to gender equality. Twenty-six universities are now Charter members, 11 have gained a bronze award and five have achieved silver.

Ethnic Minorities initiative

5.33 During the period 2005/06 - 2007/08 DTI allocated £1.5 million to fund a programme that aims to engage the most under-represented Black and Ethnic Minority (BME) secondary school students in Science, Engineering, Technology and Mathematics (STEM). Research carried out in Government Departments and by the Royal Society[11] suggests that the most under-represented ethnic groups in STEM are Afro-Caribbean boys and Bangladeshi & Pakistani girls.

STEM Access Grants

5.34 The 'STEM Access Grants' programme[12] was developed and launched during National Science Week in 2006 by DTI Minister Barry Gardiner. Schools had applied for funding of up to £10,000 per school/year to fund additional activities to enthuse young people from the BME target groups and promote STEM education and careers.

5.35 To date there have been two funding rounds; the first provided funding to 38 schools, and a further 19 schools were awarded funding in the second round. The grants have been welcomed by schools, who are using it to complement the work teachers are already doing to tackle under achievement and social exclusion in science subjects. Bob Mackenzie, Assistant Head of Challney High School for Girls in Luton comments "The number of Applied Science students expected to get grades A* to C in 2005 was 37 per cent. In 2006 it was 60 per cent, and being able to do the trips paid for by the STEM grant is the only thing that has changed. It has made such a big difference to the motivation of both staff and pupils."

[11] "Science Engineering and Technology and the UK's Ethnic Minority Population" - http://www.royalsoc.ac.uk/page.asp?id=3140

[12] http://www.dti.gov.uk/science/science-and-society/science-workforce/bme_set/page28088.html

Case Study: Park View Academy and Fortismere School, London

"I know we have been able to awaken the students' interest in STEM through this project – they are always on at me to arrange another trip! When I look at them I see the next engineer, the next doctor, the next pharmacist. The hardest part is showing the link between what they study in school and real life – these visits have made it clear."

Larbi Hamam, Head of Maths

Park View Academy and Fortismere School in North London are running a joint project to show students the link between maths and science and the world around them and to stimulate interest in a scientific career. Working in partnership with London Underground, they are using a STEM access grant of £10,000 per school to take students on visits to LU stations, organise talks by engineers and buy specialist equipment for use in school.

Thirty Year 8 pupils from each school are taking part, all from BME backgrounds. The majority are Black Caribbean, followed by Bangladeshi and Pakistani, Kurdish, Turkish and Greek. "Park View has 59 languages spoken on site," says Larbi. "Over 50 per cent are on free school meals. The challenge is to recognise and understand the different cultures, Often students are coming from a social environment where the parents have done well without education. Our job is to show them the relevance of what they are learning at school to the real world and the world of work, and to show them the opportunities. We need to show that if they aim high, they can achieve.

6 PUBLIC ENGAGEMENT WITH SCIENTIFIC RESEARCH AND ITS INNOVATIVE APPLICATIONS

This chapter highlights key achievements over the past year on building engagement and improving public attitudes to science, including:

- development of the Sciencewise programme of public dialogue on science and technology into a commissioning programme focusing on key policy areas;
- expansion of Science Week to include engineering, and increased events and attendees;
- developing a corporate memory for public engagement to support Government/science community partnerships in this area;
- continued roll-out of the Universal Ethical Code for Scientists developed by the Government's Chief Scientific Adviser.

6.1 The ten-year framework highlighted the importance that the Government attaches to greater public confidence and improved engagement in scientific research and its innovative applications. The ten-year framework set an objective to:

- demonstrate improvement against a variety of measures, such as trends in public attitudes, public confidence, media coverage, and acknowledgements and responsiveness to public concerns by policy-makers and scientists.

6.2 In November 2006, the Minister for Science and Innovation set out his desire for the UK to become a 'knowledge democracy': one where science is fully recognised and appreciated as central to both continued economic success and to improving the quality of life for all in the UK, and where more people want to become actively involved in science education and careers. There are two key elements to achieving this goal. The first is to secure improved participation and attainment in science education leading to a better qualified science workforce at all levels – with the right skills to maintain a strong science base. Chapter 5 set out progress towards this goal. The second element is to secure consistently better public engagement with science. The Government's public engagement with science programme provides a lead in this area enabling and encouraging open, constructive and informed debate on the social, ethical, health, safety and environmental implications of new and emerging science and technologies.

EVIDENCE OF PROGRESS

6.3 A number of important steps forward have been taken to increase the scale, reach and impact of work to embed public dialogue into policy and decision-making regarding key science and technology-related challenges. The Sciencewise programme has become a direct commissioning scheme, enabling resources to be targeted at providing the public with a legitimate voice in informing decisions on key science issues. In particular, Sciencewise is supporting public engagement on the future development of nanotechnology, brain science and stem cells The Research Councils' Energy public dialogue aims to identify public priorities for energy research to inform the Research Councils' strategic decision-making. In addition to current stakeholder input streams this will increase accountability for the direction of Research Council funded energy research. This study is the largest of its kind in the UK and is a follow up to earlier surveys, therefore providing longitudinal data as well as an up to date report on public views.

6.4 The Nanotechnology Engagement Group (NEG) published its final report in June 2007, and the Nanodialogues project has also completed its activities, and published its final report as a DEMOS pamphlet. NEG's report covers objectives, common findings and analysis from eight (8) projects, some of which were funded by Government. Nanodialogues approach was to conduct four (4) experiments in public dialogue with an agency, research councils, an NGO and a company. These reports have been fed into Government through the Nanotechnologies Issues Dialogue Group, to inform Government thinking regarding its approach to research and regulation related to free, engineered nanoparticles.

6.5 Government needs to continue to provide evidence of improvement towards its goal of the UK public being "confident about the governance, regulation and use of S&T, by both government and industry, to be positively engaged with science activity and feel that its views are valued". DIUS, with RCUK, is commissioning the third in a series of surveys on Public Attitudes to Science, which will be conducted in late 2007 and report in early 2008.

KEY HIGHLIGHTS

Openness, dialogue and effective communication with the public

Sciencewise

6.6 The Sciencewise Programme has continued to develop projects that support key policy areas in 2006 and 2007. Through the programme, £1.5 million has been committed to projects on a range of critical science challenges, including brain science, stem cells research, nanotechnology and a range of new and emerging technologies identified through the Horizon Scanning Centre. New projects have been funded in:

- Brain Science Addiction and Drugs – resulting from the Foresight report and led by DH and the Academy of Medical Sciences (AMS), this project drugsfutures will embed public dialogue into the Academy's process of advising the Government on future research and regulation around the use of psychoactive substances (such as cognition and mood enhancing drugs); and

- Sciencehorizons, the first ever mass public engagement programme designed to get the nation talking about how science and technology could affect our lives in the next 15-20 years in conjunction with the Horizon Scanning Centre. The results of the £330,000 project will inform policies and decisions regarding the direction of research and regulation of science and technology. The project seeks to involve community groups, schools, families and friends in their own sciencehorizons discussions using discussion packs which include stories, cartoons and a CD-ROM to prompt discussion. They cover four topics based on a series of scenarios showing how life in 2025 could differ from today: mind and body, home and community, work and leisure and people and planet.
- the Human Fertilisation and Embryology Authority (HFEA) has been awarded £60,000 to run a public dialogue project to support consultation on the ethical and social implications of creating human/animal embryos in research which was launched in April.
- in March, the UK's two major funders of stem cell research, BBSRC and MRC, were awarded a Sciencewise grant of £300,000 to run a programme to bring scientists and the public together to identify public expectations, aspirations and concerns about stem cell research.

Council for Science and Technology (CST)

6.7 Through the Sciencewise programme, a scoping study was conducted to take forward the recommendation from the Council for Science and Technology's (CST) report 'Policy Through Dialogue' to develop a "corporate memory" with regard to public dialogue on science and technology. An Expert Resource Centre on Public Dialogue in Science & Innovation is now being developed as part of the next 3-year phase of Sciencewise to start in April 2008. The Resource Centre will build capacity across government (Departments and Agencies) for dialogue on key science and innovation issues and will capture and disseminate best practice, with the aim of integrating public engagement and dialogue in the development of policy.

Ethics in science, engineering and technology

6.8 The Chief Scientific Adviser issued a challenge to the UK scientific community in March 2007 to adopt the Universal Ethical Code for Scientists, 'Rigour, Respect and Responsibility', following consultation and piloting amongst key government departments. The code pilot ended in September 2006, and plans are being developed to roll out further across Government and then to extend it into the wider science, engineering and technology community.

New policy developments

IP awareness

6.9 For the Intellectual Property system to be effective it is crucial that inventors and business recognise its value, understand how it operates and know how to use it. The UK Intellectual Property Office has been actively pursuing various IP awareness raising measures. In the business sector, UKIPO runs a "What is the Key" campaign in partnership with other organisations, notably RDAs. This includes awareness raising events and distribution of various IP resource material. UKIPO is building on these initiatives by pursuing new awareness raising activities, notably the piloting of an IP health check scheme designed to help small businesses identify what IP they possess and offer advice on how to protect, use and maximise its value.

Box 6.1: Beacons for Public Engagement

This £8 million initiative is the collective response of the Research Councils and the UK's Funding Councils to calls from the academic community to strategically address the need to reward and recognise public engagement at an institutional level. There was an overwhelming response from the academic community with almost 90 applications for the initiative which aims to fund around six Beacons.

By working in partnership with the Higher Education Funding Council for England (HEFCE), Scottish Funding Council (SFC), Higher Education Funding Council for Wales (HEFCW) and the Wellcome Trust, matched funding has been secured to launch one of the biggest projects to support public engagement ever seen in this country and significantly raise the profile of the Research Councils amongst the community. The development of the initiative was supported by the Royal Society, NESTA, Universities UK, the British Academy (BA), and the Royal Society of Arts amongst other stakeholders.

Roundtable discussions

6.10 The Minister for Science and Innovation has also set up a series of discussion meetings with leading science and social science researchers in areas that demonstrate UK scientific excellence. These focused on the topic of Stem Cells in March, the Basic Biology of Ageing in April and Earth-like and Habitable Planets in June. The discussions have helped to develop a better understanding of the current status and UK capability in these areas. The discussions incorporate a media element as developments in science will raise a wide variety of questions and the media have an important role and responsibility for communicating these accurately.

7 Science and innovation across Government

The ten-year framework highlighted that science and innovation are not only key drivers of wealth creation, but also underpin evidence-based policy making and improved service delivery. Government therefore needs to use – and be seen to use – the highest quality science and scientific advice.

Over the past twelve months, Government has:

- published the Energy White Paper;
- continued its rolling programme of departmental Science Reviews;
- responded to the Council for Science and Technology (CST) Nanotechnology Review;
- started a new Foresight Project – Mental Capital and Wellbeing; and
- responded to the House of Commons Select Committee Inquiry into Scientific Advice, Risk and Evidence Based Policy Making.

EVIDENCE OF PROGRESS

7.1 The rolling programme of departmental Science Reviews has continued, with the publication of three reports in the last year with positive responses to the recommendations from the departments concerned, and the initiation of two new reviews in 2007.

7.2 A Head of Science and Engineering Profession (HoSEP) network has been created to support the science and engineering community across Government. This group works closely with the Chief Scientific Advisers Committee to coordinate advice and guidance to Government.

7.3 The Government announced its intention to establish a new energy and environment research institute in 2006. Work on the Energy Technologies Institute (ETI) is progressing, a Prospectus outlining the Institute's aims was published in September 2006 (see Chapter 4 for more details).

KEY HIGHLIGHTS AND NEXT STEPS

Cross-Government working

Civil Service Steering Board

7.4 The Civil Service Steering Board (CSSB) was established in 2007 and leads on the identification and management of strategic challenges and risk to Government. This includes the use of analysis and evidence – of which science and engineering plays a part. The CSSB will build on work undertaken previously by the Co-ordination of Research and Analysis Group (CRAG) and the Strategy Sub-Group of the Permanent Secretaries Management Group.

Head of Profession

Head of Science and Engineering Profession (HoSEP)

7.5 The principal role of the Head of Science and Engineering Profession (HoSEP) is to help build and support the community of scientists and engineers within Government. As part of this remit a Skills Framework and an associated Learning and Development Document for the profession has been developed. Departmental HoSEPs meet regularly to identify and address issues that impact on the science and engineering community.

Working with advisory groups

Council for Science and Technology (CST)

7.6 Council for Science and Technology (CST) is the UK Government's top-level independent advisory body on science and technology policy issues. The Council discussed key innovation and wealth creation issues with the Prime Minister – in particular energy, research and development in the services sector, the role of public procurement in promoting innovation, and how Government might stimulate growth of high-technology SMEs. In March 2007, the Prime Minister appointed existing CST member Professor Janet Finch as the new independent co-chair. Three new members were appointed to the Council, joining 13 members who were re-appointed.

7.7 Over the last year, CST's major reports have covered: 'Health Impacts - A Strategy Across Government' (December 2006) which set out how government departments can incorporate health issues when developing and delivering their policies; 'Nanoscience and Nanotechnologies: A Review of Government's Progress on its Policy Commitments' (March 2007) which reviewed progress on actions set out in the Government's response to the Royal Society/Royal Academy of Engineering report on nanotechnology; and improving the early careers of researchers (July 2007). In July 2007 CST also delivered advice to Government on the best areas to focus resources for science, technology and innovation.

Measuring Government Performance

Science Reviews

7.8 The Science Review team has continued its rolling programme of independent reviews of science in Government Departments. The review of the Department for Environment Food and Rural Affairs (Defra) was published in December 2006 and the Health and Safety Executive (HSE) and Communities and Local Government (CLG) reviews were published in the beginning of 2007. All three departments responded positively. The Home Office is currently under review, and the review of the Department of Health (DH) has just been launched. Some of the common themes which have emerged from the reviews are:

- a growing recognition of horizon scanning's importance in improving departments' capabilities to address risks and opportunities;
- the challenges of structural differences in the way departments organise and deliver their science; and
- science and scientific advice is underused in formulating policy.

Science and Innovation Strategies

7.9 The Government Chief Scientific Adviser (GCSA) has been working with Government Departments to ensure that they produce Science and Innovation (S&I) Strategies. These S&I Strategies show how research programmes and other science related activities contribute to the delivery of departmental priorities and objectives and Public Services Agreement (PSA) targets. The value of S&I strategies has become widely recognised, to the extent that some Agencies and Devolved Administrations have introduced their own voluntarily. Some Departments have benefited from drawing on the experience of those who pioneered the development of these strategies. As the wider debate has matured about better integration of all evidential streams, Defra has led the way in creating a second generation "Evidence and Innovation Strategy" which is now being looked at closely by Other Government Departments, to help further embed evidence-based policy-making and delivery. Almost all Departments have now completed an S&I or E&I strategy. In June, the Home Office published the UK's first Security and Counter-terrorism Science and Innovation Strategy.

Priority issues

Energy

7.10 In January 2006 the joint public/private Energy Research Partnership was launched to provide enhanced leadership and coherence to the total UK investments in energy research and innovation. An early initiative of the Partnership has been to support the establishment of the new Energy Technologies Institute. With potential funding from Government and industry of more than £1 billion over 10 years, the Institute will add both ambition and focus to UK energy innovation, accelerating key technologies towards commercial deployment (see Chapter 4 for more details).

7.11 In May 2007 the Government published an Energy White Paper, following its Energy Review in 2006. The White Paper includes a range of measures to meet the Government's energy and environmental goals, including support for low carbon technologies at all stages of the innovation chain from early stage research through to incentives for deployment.

Nanotechnologies

7.12 In February 2005 the Government published a report[13] setting out its agenda for the responsible development of nanotechnologies in the UK. These activities are coordinated by the Nanotechnology Issues Dialogue Group (NIDG).

The Government has published a number of documents since including:

- an outline programme for public engagement on nanotechnologies[14];
- the first Government research report on characterizing the potential risks posed by engineered nanoparticles[15] – identifying nineteen research objectives, followed by a progress report in October 2006;
- evidence submitted to the review by the Council for Science and Technology (CST) of the Government's delivery of its commitments on nanotechnologies[16];

[13] http://www.dti.gov.uk/files/file14873.pdf

[14] http://www.dti.gov.uk/files/file27705.pdf

[15] http://www.defra.gov.uk/environment/nanotech/research/pdf/nanoparticles-riskreport.pdf;

[16] http://www.dti.gov.uk/files/file34431.pdf

- as well as reviews by Defra, HSE and the Food Standards Agency (FSA), an independent overview of the adequacy of current regulatory regimes in relation to nanotechnologies[17];
- in June 2007 Demos and the Nanotechnology Engagement Group launched the results of the Government-funded programme of public engagement on nanotechnologies (see also Chapter 6); and
- the Government's response to the CST's report on nanotechnologies outlined plans to address areas such as research into potential health implications, where further progress is needed.

Futures work

Horizon Scanning Centre (HSC)

7.13 Launched in March 2005, the Horizon Scanning Centre (HSC) looks at least five to ten years ahead to identify and examine potential opportunities and threats. HSC have created and piloted processes for Horizon Scanning and leveraging evidence from across analytical workstreams.

7.14 As anticipated in the last report, the Sigma (issues across the public policy spectrum) and Delta (S&T) Scans were published in the autumn of 2006, and received global press coverage.

7.15 The HSC has now worked with most departments, through various cross departmental projects such as: the International Futures Project; the HMT Public Private Forum on Identity Management; the Wider Implications of Science and Technology (WIST) project and others.

7.16 To raise capability across Government, the HSC is working with the National School of Government on Professional Skills for Government (PSG) training and has led events attended by over 800 people, including ministers. The Strategic Futures online toolkit has been downloaded more than 1700 times since its publication in March 2005.

7.17 In publishing the HSC's S&T work as the underpinning framework for the Comprehensive Spending Review (CSR) emerging technologies work, the Treasury described Horizon Scanning as a vital tool. The Centre has also been commended by the House of Commons Select Committee on Science and Technology.

Projects

7.18 Foresight is the Government's science-based think tank, providing challenging visions of the future to ensure effective strategies now. It provides evidence on strategic cross-departmental future policy. Recent projects include Intelligent Infrastructure Systems and Detection & Identification of Infectious Diseases[18]. All projects feature diverse groups of specialists working in a multidisciplinary framework. Current projects are Tackling Obesity: Future Choices, which reports in autumn 2007; Mental Capital & Wellbeing; and Sustainable Energy Management & the Built Environment, both of which report in 2008. A new project is due to begin in autumn 2007.

[17] http://www.dt.gov.uk/files/file36167.pdf

[18] http://www.foresight.gov.uk

Case study: Foresight: Intelligent Infrastructure Systems Project

The impact of the Foresight project on Intelligent Infrastructure Systems was reviewed in February 2007. Conclusions were that in achieving its aim, the Project has:

- provided a clear framework for how the UK might deliver long-term, sustainable and robust transport solutions through the use of intelligent infrastructure;
- provided an overarching framework to inform Government's research and development programme;
- led to and defined the scope and criteria for a £12 million research platform on future intelligent transport systems; and
- provided the basis for engagement with the next generation on the challenges which society faces in delivering sustainable transport, for example through work with the Association of Science Education and the London Transport Museum.

8 GLOSSARY

AHRC	Arts and Humanities Research Council
AMS	Academy of Medical Sciences
AURIL	Association for University Research and Industry Links
BA	British Academy
BBSRC	Biotechnology and Biological Sciences Research Council
BERD	Business expenditure on research and development
BERR	Department for Business, Enterprise and Regulatory Reform
BME	Black and Ethnic Minority
CCLRC	Council for the Central Laboratory of the Research Councils
CLG	Communities and Local Government
CPD	Continuing Professional Development
CRAG	Coordination of Research and Analysis Group
CSAC	Chief Scientific Advisers' Committee
CSR	Comprehensive Spending Review
CCSB	Civil Service Steering Board
CST	Council for Science and Technology
DCLG	Department of Communities and Local Government
DCSF	Department for Children, Schools and Families
DEFRA	Department for Environment, Food and Rural Affairs
DELNI	Department for Employment and Learning Northern Ireland
DfES	Department for Education and Skills
DfID	Department for International Development
DfT	Department for Transport
DH	Department of Health
DIUS	Department for Innovation, Universities and Skills
DTAs	Doctoral Training Accounts
DTGs	Doctoral Training Grants
DTI	Department of Trade and Industry
EPSRC	Engineering and Physical Sciences Research Council
ERC	European Research Council
ESRC	Economic and Social Research Council
ETI	Energy Technologies Institute
FP	Framework Programme
FEC	Full Economic Cost
FCO	Foreign and Commonwealth Office
FSA	Food Standards Agency
GERD	Gross Domestic Expenditure on Research and Development
GCSA	Government Chief Scientific Adviser
GSIF	Global Science and Innovation Forum
GTP	Graduate Teacher Programme

HEB-CI	Higher Education – Business Community Interaction Survey
HEFCE	Higher Education Funding Council for England
HEFCW	Higher Education Funding Council for Wales
HEI	Higher Education Institution
HEIF	Higher Education Innovation Fund
HESA	Higher Education Statistics Agency
HFEA	Human Fertilisation and Embryology Authority
HLTA	Higher Level Teaching Assistant
HMRC	HM Revenue and Customs
HoSEP	Head of Science and Engineering Profession
HSC	Horizon Scanning Centre
HSE	Health and Safety Executive
IOG	Interim Oversight Group
IP	Intellectual Property
JCPSG	Joint Costing and Pricing Steering Group
JTI	Joint Technology Initiative
KIC	Knowledge Integration Communities
KTN	Knowledge Transfer Network
KTP	Knowledge Transfer Partnership
LFCF	Large Facilities Capital Fund
MRC	Medical Research Council
NAO	National Audit Office
NDPB	Non-Departmental Public Body
NEG	Nanotechnologies Engagement Group
NERC	Natural Environment Research Council
NESTA	National Endowment for Science, Technology and the Arts
NIDG	Nanotechnology Issues Dialogue Group
NIHR	National Institute for Health Research
NMS	National Measurement System
NPL	National Physical Laboratory
NSSF	National Standardisation Strategic Framework
OECD	Organisation for Economic Cooperation and Development
OGC	Office of Government Commerce
OGD	Other Government Department
OSCHR	Office for the Strategic Coordination of Health Research
OSI	Office of Science and Innovation
PGA	Partial General Approach
PPARC	Particle Physics and Astronomy Research Council
PSA	Public Services Agreement
PSG	Professional Skills for Government

PSRE	Public Sector Research Establishments
QCA	Qualifications and Curriculum Authority
QIA	Quality Improvement Agency
QR	Quality Related Block Grant
R&D	Research and Development
RAE	Research Assessment Exercise
RCUK	Research Councils UK
RDA	Regional Development Agency
RES	Regional Economic Strategies
RESUK	Research Establishment Sustainability Forum
RTD	Research and Technological Development
SBRI	Small Business Research Initiative
SEEDA	South East England Development Agency
SET	Science Engineering and Technology
SETNET	Science Engineering and Technology Network
SFC	Scottish Funding Council
S&I	Science and Innovation Strategy
SI	Cabinet Committee on Science and Innovation
SME	Small and Medium Enterprise
SRIF	Science Research Investment Fund
SSA	Sector Skills Agreements
SSC	Sector Skills Councils
STEM	Science, technology, engineering and mathematics
STFC	Science and Technology Facilities Council
SWAN	Scientific Women's Academic Network
TDA	Training and Development Agency for Schools
TQI	Teaching Quality Information
TRAC	Transparent Approach to Costing
TSB	Technology Strategy Board
TTA	Teacher Training Agency
UKAEA	UK Atomic Energy Authority
UK-CDS	UK Collaborative on Development Sciences
UKIERI	UK India Education and Research Initiative
UK-IPO	UK Intellectual Property Office
UKRC	Resource Centre for Women in Science, Engineering and Technology
UKSCI	UK Stem Cell Initiative
UKTI	UK Trade and Investment
WITE	Water, Infrastructure and Treatment Engineering

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